A description of Neophyllobius aesculi n. sp. and its developmental stages (Acari: Camerobiidae)

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ABSTRACT. — The stilt-legged mite *Neophyllobius aesculi* n. sp. and its developmental stages, all collected from horsechestnut in Amsterdam, are described. It is questioned whether the lifecycle of *Neophyllobius* includes two nymphal stages instead of one. *N. aesculi* has spinning abilities, and exhibits haplo-diploidy. The mitotic chromosome numbers are 2n = 22 and n = 11.

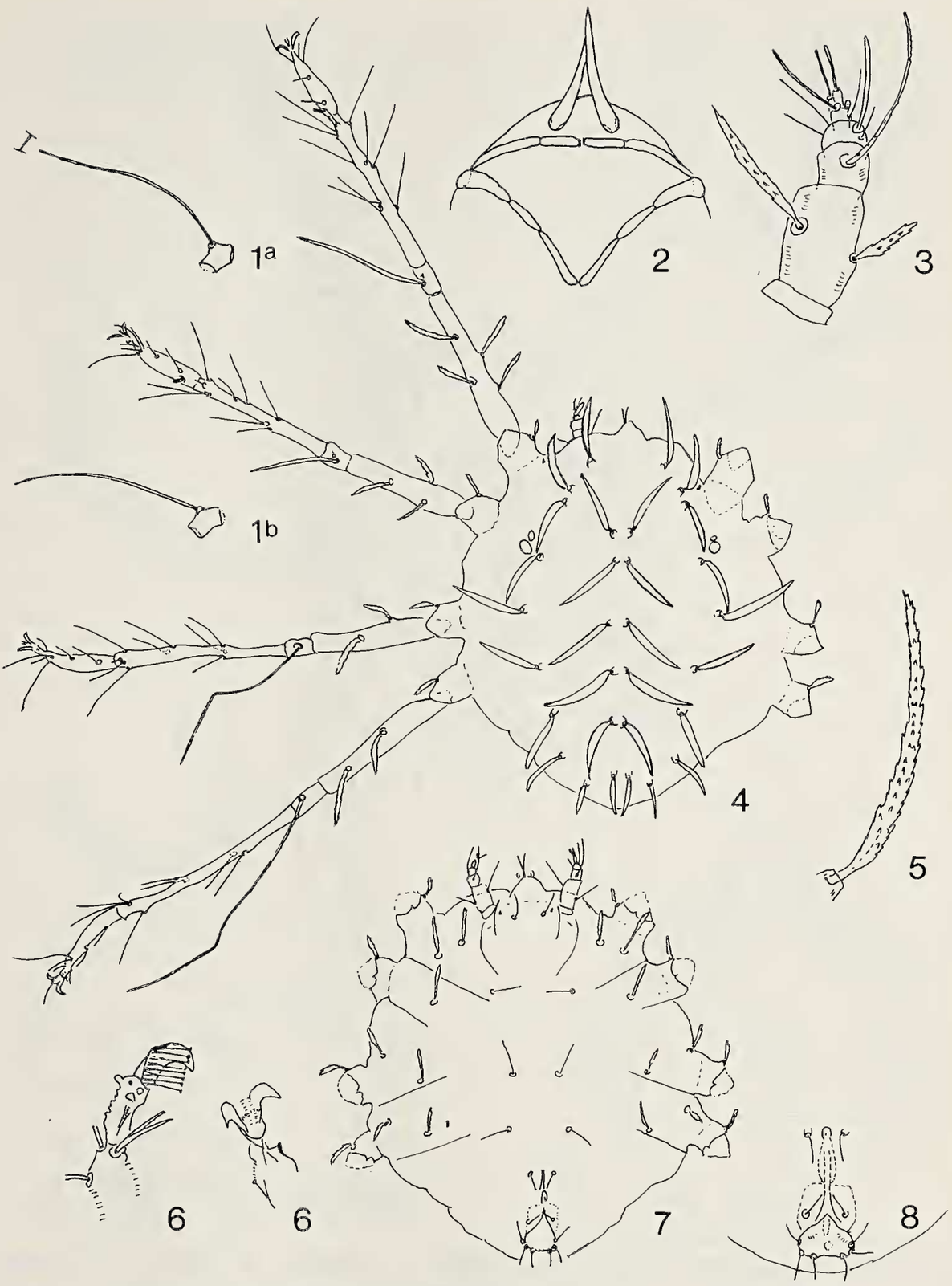
The genus *Neophyllobius* Berlese, belonging to the family Camerobiidae (Southcott, 1957; Gerson, 1972), comprises at present 40 species. The study on the genus is hampered by the fact that these stilt-legged mites are usually found in very low numbers. Descriptions of new species are often based on only one individual (16 of the total of 40 species are known only from the holotype), in some cases just a few individuals were studied. Because of the scarcity of material, the knowledge of the different developmental stages is fragmentary. Even the distinction between the sexes is not always clear.

In 1977, I examined a series of leaf samples of *Aesculus hippocastanum* L. and found quite a lot of adults, eggs and developmental stages of a new *Neophyllobius* species. In addition to the egg, larva, protonymph and adult, an additional stage was found which presumably represents the deutonymph. In the present paper a description of this new species and a detailed characterization of the developmental stages are presented.

Neophyllobius aesculi sp. n.

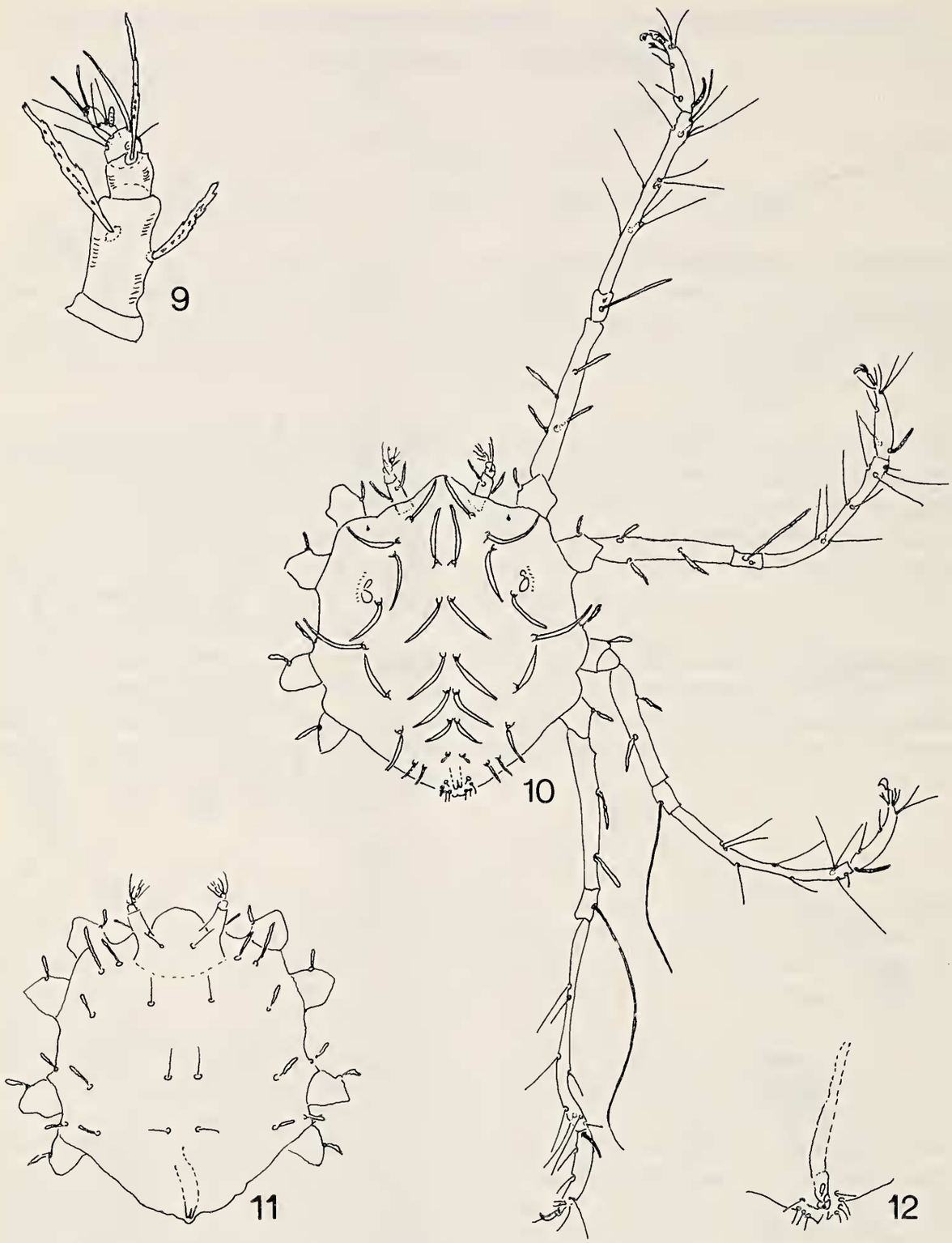
Female. — Shape of the female is slightly ovate in dorsal outline (figs. 4 and 7), being the widest in front of coxae III. Length 340 μm, width 280 μm. The orange-reddish pigmentation of the hemolymph, caused presumably by carotenoids, gives the mite a conspicuous colour. The midgut is dorsally visible as a white, medial stripe in the hysterosoma. Eyes are present as two separate pairs of ocelli situated laterally on the propodosoma. There are 6 pairs of dorso-central setae (dc_1 60 μm; dc_2 70 μm; dc_3 60 μm; dc_4 65 μm; dc_5 60 μm; dc_6 35 μm) and 9 pairs of dorso-laterals (dl_1 60 μm; dl_2 55 μm; dl_3 55 μm; dl_4 55 μm; dl_5 70 μm (fig. 5); dl_6 55 μm; dl_7 55 μm; dl_8 40 μm; dl_9 30 μm) all located on tubercles. One short, supra coxal seta (eI) (cf. Robaux, 1975) is situated laterally of dl_2. There are 4 pairs of ventral setae, not inserted on tubercles: 1 pair close together between the palpal basis, 1 pair located near the mesal margin of coxae I, 1 pair in line with coxae III and 1 pair in line with coxae IV. In addition, there are two pairs of setae in the genital area and 3 pairs of anals (fig. 8). Ventrally, close to the palpal basis, is a pair of supra-coxal setae (e) (cf. Robaux, 1975) which are hardly discernible.

Legs much longer than the body: I 445 μm, II 385 μm, III 425 μm and IV 470 μm in length. The leg setation is as follows: Coxa I 2, II 1, III 2, IV 2; Trochanter I 1, II 1, III1, IV 1; Femur I 4, II 3, III2, IV 2; Genu I 1, II 1, III 1, IV 1; a minute solenidion is also present on I and II. The seta on I (length 125 μm) reaches to the second row of setae on the tibia, the seta on II (75 μm) to the first and second row on the tibia, the seta on III (155 μm) to the end of the tibia and that on IV (255 μm) up to the tarsal end; Tibia I 9, II 8, III 8, IV 7; moreover a subterminal annulated rod-like solenidion is located on I (the longest), II, III and IV; Tarsus: two ventral unpaired setae on second third of tarsi I, II, III and IV. Eight setae at the distal end of I, 8 on II, 6 on III and IV (figs. 6). Two setae are bifid, the six others are simple. A subbasal striated and rod-like solenidion on I and II only. The empodium is pad-like, provided with two rows of 8 capitate tenent hairs.



Figs. 1-8. *Neophyllobius aesculi* n.sp. 1. deutonymph; 1a. genu I; 1b. genu II; 2-8. female. 2. peritremata and stylets; 3. pedipalp; 4. dorsum; 5. dorsolateral hair (dl_5); 6. tarsal appendages; 7. venter; 8. genital area.

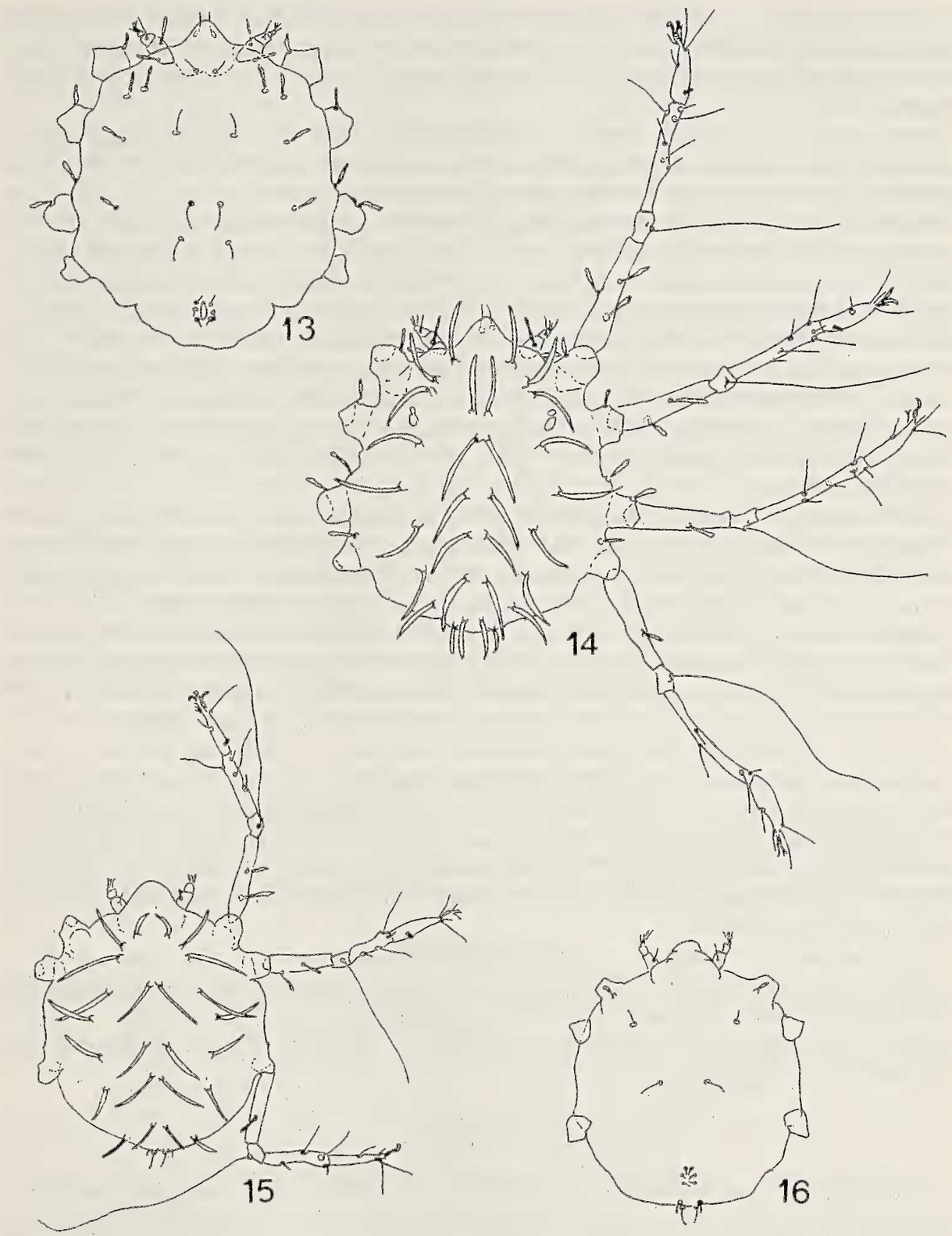
The pedipalps have 5 segments (fig. 3). The palpal femur bears 2 barbed lanceolate setae, unequal in length. The palpal genu with one elongate, barbed seta; the palpal tibia with 3 hair-like setae and a blade-like dorsal seta. The palpal tarsus is flash-like, at the base of the small part a striated rod-like solenidion is found. The palpal tarsus bears 4 other setae, of which two blunt-tipped eupathidia are situated terminally.



Figs. 9-12. *Neophyllobius aesculi* n.sp., male. 9. pedipalp; 10. dorsum; 11. venter; 12. aedeagus.

The movable digits of the chelicerae are stylet-like, rather short and with a curved proximal end (fig. 2). It is not clear whether the fixed digits are fused and form a stylophore. The gnathosoma is retractable. The peritremes consist of 2 arcs on each side (fig. 2). The posterior arcs include 3 chambers each, which are laterally in open connection with the air. The anterior arcs are two-chambered. A pair of ascending tracheal vessels meet at the medial connection between the anterior arcs.

Male. — The shape of the body is similar to that of the female (figs. 10 and 11). Length 275 µm, width 250 µm. A simple, straight aedeagus (fig. 12), which is split distally, is clearly visible.



Figs. 13-16 *Neophyllobius aesculi* n.sp. 13-14. protonymph. 13. venter; 14. dorsum; 15-16. Larva. 15. dorsum; 16. venter.

The tibia of the male is longer than that of the female. The dorso-centrals, especially dc_6 (only 10 µm), are much shorter than in the female. Dl_5 is half as long as that of the female. Genital setae are absent. Four pairs of anals (fig. 12), close together, (compared to the 3 pairs in the female (fig. 8), are situated more posteriorly than in the female. The number of setae on the trochanter, femur and genu is similar to that of the female. However, the length of the genual seta of the male is shorter. A blunt-tipped, long "male" solenidion is situated subterminally on tibia I. In addition, there is a minute nail-like solenidion at the distal end. On tarsi I, II, III and

IV, more basal than in the female, a long, curved annulated rod-like solenidion is present. The palpal setation of the male and female is similar (fig. 9). The palpal femur of the male is smaller; the annulated rod-like solenidion on the palpal tarsus is longer in comparison to that of the female.

Deutonymph. — The deutonymph is very similar to the adult. The most conspicuous difference is the form and length of the genual setae (fig. 1): the setae on genua I and II have still the typical flagelliform shape of the juvenile stages (larva and protonymph).

Protonymph. —The size of the body (figs. 13 and 14) is slightly smaller than that of the female (length: 210 μm-310 μm, width 175 μm-275 μm). The leg setation is different from that of the adult and the deutonymph. The setae on coxa IV and on trochanter IV are lacking. Femur I 3, II 2, III 1 and IV 1. Setae on genua I, II, III and IV flagelliform and surpasses the tarsus. Tibia I 5, II 5, III 5, IV 3; the setae on the tibia are rather short. Tarsus I, II, III and IV with only 1 ventral seta in the middle. The striated rod-like solenidion on the palpal tarsus is absent.

Larva. —The hexapod larva (figs. 15 and 16) is smaller than the protonymph. The first dorso-centrals (dc_1), are lacking. Only 2 pairs of ventrals and 3 pairs of anal setae are present. Coxa I 1, II 0 and III 0. Femur I 2, II 2 and III 1. Tibia I 3, II 3 and III 3, each with an additional rod-like solenidion.

Resting stage. — 3 Resting stages between larva and protonymph ("protochrysalis"), and 6 resting stages between protonymph and deutonymph ("deutochrysalis") were studied. The gross shape of the resting stage is similar to that of the active stage. The 6 deutochrysalids showed clearly the characteristic form and length of the genual setae of both stages.

Egg. — The egg is dark red with a smooth surface. It is rounded, flattened and provided with a hair on top. Eggs were found in all crevices of 2-year-old twigs of the horse-chestnut *Aesculus hippocastanum*. Eggs are covered with a flat, very dense webbing, which covers the pit or crevice in which the egg is hidden. The white, dense webbing veils the red colour of the egg.

Eggs were squashed (orcein-squash technique, Helle & al., 1980) and different mitotic prophases and metaphases were found in the embryonic tissue. It appears that there are eggs with $2n = 22$ and with $n = 11$ chromosomes, indicating a haplo-diploid sex-determination, like in many other prostigmatic taxa (for instance in the spider mites, see Helle & al., 1981). In a previous paper (Gutierrez & al., 1979) this number was erroneously ascribed to *N. elegans* Berlese. The chromosomes are very small (1-2 μm) and are similar to the holokinetic chromosomes of the Tetranychidae.

Type material. — Holotype (an adult female) 13 Paratypes (1 female, 1 male, 4 protonymphs, 6 chrysalids and 1 larva, labelled $1977/B_1$ and $1977/B_2$, in Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam. 38 Paratypes (2 females, 4 males, 2 deutonymphs, 19 protonymphs, 3 chrysalids and 8 larvae), in collection of the Laboratorium voor Experimentele Entomologie.

DISCUSSION

N. aesculi differs from most other species by the leg chaetotaxy and by the number and shape of the dorsal body setae. *N. aesculi* resembles *N. saxatilis* (Halbert, 1923) (c.f. van Eyndhoven, 1938). An examination of the type material of *N. saxatilis* revealed that this species differs from *N. aesculi* by the shape of its idiosoma (length 320 μm, width 210 μm), by the length of the legs (I is lacking, II 340 μm, III 380 μm, IV 435 μm) and by the length of the genual hairs (I 110 μm, II mutilated, III 125 μm, IV 260 μm). The dorsal setae are also shorter in *N. saxatilis*; especially dl_5 which is only 80 μm (135 μm in *N. aesculi*). The distance between dc_1 and dc_2 in *N. aesculi* is less than half as long as the distance between dc_2 and dc_3. In *N. saxatilis* the distance between dc_1 and dc_2 is nearly equal to that between dc_2 and dc_3. The most distal seta on femora I, II, III and IV of *N. aesculi* reaches the genu. In *N. aesculi*, the length of the seta on genu III is much shorter than that of *N. saxatilis*. Comparing the material of *N. aesculi* with that of *N. saxatilis* collected by G. L. van Eyndhoven (1938), similar differences have been observed. However, in my opinion, the *Neophyllobius* species collected by van Eyndhoven is different from the type

material of *N. saxatilis*, because of an aberrant setal formula on tibia IV.

In the descriptions I did not describe the integumentary striae. Although the striation pattern might be of taxonomic significance, its practical value is doubtful. In the many individuals of *N. aesculi* studied it appeared that the striation pattern is easily affected by slide prèparation, so that in only a few individuals the pattern could easily be studied.

The existance of a deutonymph, which can only be distinguished from the adult by the form and length of the genual setae, is of importance for the recognition of this species. It is noticeable that the interpretation of the two specimens as deutonymphs is mainly based on the study of deutochrysalid material. Teleiochrysalids, however, have not been found. Neither is direct evidence from rearing experiments available.

The stilt-legged mites were kept under laboratory conditions on chestnut branches for a period of several days. Regular observations lead to the following remarks on the behaviour of the mite. It appears that the adults have a definite shelter, which is covered by a roof, such as a chip or a scale. Only on branches with such shelters the stilt-legged mite was found. When at rest, the adult sits with the body and the legs flat. The genual setae, however, are directed upwards. When they are alarmed, the mite rises. The stilt-legged mite moves with "deliberation", even when disturbed. Except for the tactile function of the genual setae, they as well as the legs may have an autotomic purpose in case of seizure (like legs of the harvest-spiders). It was observed that on chestnut the mites prey on eriophyid mites: they perforate a gall-mite with their stylets which protrude downwards from the movable gnathosoma; the prey was then brought to their shelters where it was consumed.

It was mentioned previously that the egg of *N. aesculi* is covered with a dense webbing. I observed a female spinning a webbing on the surface of a freshly laid egg. However, it was not clear, if the silk is produced by one or both of the most distal setae (or eupathidia, Robaux, 1975) on the palpal tarsus, as is the case in the spider mites.

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